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Solution by C. E. WHITE, Vanderbilt University, Nashville, Tenn.

$\log^n x = \log\log\log\ldots(n \text{ times})\, x$.

$$\therefore d\log^n x = \frac{d(\log^{n-1})}{\log^n x} = \frac{d\log^{n-2}x}{\log^n x\log^{n-1}x} = \ldots = \frac{dx}{\log^n x\ \log^{n-1}x\ \log^{n-2}x\ldots\log x . x}.$$

Also solved by J. Scheffer. Some of our readers misinterpreted the meaning of the notation. It should be remembered that the notation means the log of the log of the log, etc., n times, of x. See Byerly's *Integral Calculus*, 2d Ed., p. 2. ED. F.

251. Proposed by PROF. R. D. CARMICHAEL, Anniston, Ala.

Find in terms of x the functions c_1x and c_2x defined, respectively, by the relations (a) $x\log(c_1x) = c_1x\log x$,
(b) $x\log x = c_2x\log(c_2x)$.

Solution by G. B. M. ZERR, A. M., Ph. D., 4243 Girard Avenue, Philadelphia, Pa.

(a) We may write (a) thus, $\log(c_1x)^x = \log x^{c_1x}$.

$\therefore (c_1x)^x = x^{c_1x}$, or $c_1x = x^{c_1} = 1 + c_1\log x$

$$+\frac{c_1^2}{2\,!}(\log x)^2 + \ldots + \frac{c_1^n}{n\,!}(\log x)^n + \ldots$$

(b) Similarly, we may write (b), $\log x^x = \log(c_2x^{c_2x})$.

$$\therefore x^x = (c_2x)^{c_2x},\ \text{or}\ c_2x = x^{1/c_2} = 1 + \frac{1}{c_2}\log x + \frac{1}{2!\,c_2^2}(\log x)^2 + \ldots + \frac{1}{n!\,c_2^n}(\log x)^n + \ldots$$

Also solved by J. Scheffer, C. E. White, and V. M. Spunar. Mr. Spuňar, in his solution, used the calculus.

MECHANICS.

131. Proposed by F. P. MATZ.

If the distribution of weight on the foundations of a building is W lb. /(feet)^2, the foundation must be sunk $D = (W/w)\tan 4(\frac{1}{4}\pi - \frac{1}{2}\psi)$ feet deep in earth of density w lb./(feet)^2 and angle of repose ψ.

Solution by G. B. M. ZERR, A. M., Ph. D., 4243 Girard Avenue, Philadelphia, Pa.

Let E represent the weight of a portion of a horizontal stratum of earth which is displaced by the foundation of a structure, S the utmost weight of that structure consistent with the power of the earth to resist displacement, ψ the angle of repose of the earth. Then $S/E = [(1+\sin\psi)/(1-\sin\psi)]^2$ (see paper "On Stability of Loose Earth," read before the Royal Society on the 19th of June, 1856, and published in the *Philosophical Transactions* for that year). In the problem, $E = Dw$, $S = W$.

$$\therefore \frac{Dw}{W} = \left(\frac{1-\sin\psi}{1+\sin\psi}\right)^2 = \left(\frac{1-\cos(\frac{1}{2}\pi-\psi)}{1+\cos(\frac{1}{2}\pi-\psi)}\right)^2.$$

$$\therefore D=\frac{W}{w}\tan^4(\tfrac{1}{4}\pi-\tfrac{1}{2}\psi),\ \text{since}\ \sqrt{\frac{1-\cos\theta}{1+\cos\theta}}=\tan\tfrac{1}{2}\theta.$$

160. Proposed by F. P. MATZ.

Given the para-centric acceleration c^2/r^4 and the angular velocity $(n/m)\pi$ to determine the equation of the orbit.

Solution by G. B. M. ZERR, A. M,, Ph. D., 4243 Girard Avenue, Philadelphia, Pa.

The acceleration along the radius vector is given by $d^2r/dt^2-r(d\theta/dt)^2$.

$\therefore d^2r/dt^2-r(d\theta/dt)^2=c^2/r^4$.

The angular velocity is constant and equal to $\pi(n/m)=\beta=d\theta/dt$.

$\therefore d^2r/dt^2-r\beta^2=c^2/r^4$. But $dt=d\theta/\beta$.

$\therefore \beta^2(d^2r/d\theta^2)-r\beta^2=c^2/r^4$. $\quad\beta^2[(dr/d\theta)^2+r^2]-2r^2\beta^2=A-c^2/3r^3$.

$$\therefore \beta^2\left[\frac{1}{r^4}\left(\frac{dr}{d\theta}\right)^2+\frac{1}{r^2}\right]-\frac{2\beta^2}{r^2}=\frac{A}{r^4}-\frac{c^2}{3r^7}.$$

$$\therefore \frac{\beta^2}{p^2}-\frac{2\beta^2}{r^2}=\frac{A}{r^4}-\frac{c^2}{3r^7},\ \text{since}\ \frac{1}{p^2}=\frac{1}{r^4}\left(\frac{dr}{d\theta}\right)^2+\frac{1}{r^2}.$$

$\therefore 3\pi^2(n/m)^2r^7+p^2c^2=3p^2[Ar^3+2r^5\pi^2(n/m)^2]$ is the r and p equation.

191. Proposed by DR. L. E. DICKSON, The University of Chicago.

Give the axiomatic principle of Physics which is equivalent to the theorem on the compound of two circles ("Graphical Methods in Trigonometry," MONTHLY, June-July, 1905, pp. 129-133).

Remarks by the PROPOSER.

On page 14 of the present volume, the principle is stated to be that of the parallelogram of forces (or of velocities). This answer is insufficient, as the compound of two circles relates to an infinitude of lines. A complete solution is as follows:

Two forces, represented in magnitude and direction by *OP* and *OR* have as their resultant the force represented by the diagonal *OQ* of the parallelogram *OPQR*. If we take the components of these forces along an arbitrary straight line *OS*, the sum of the components of *OP* and *OR* must equal the component of *OR*. But in the figure (Vol. XII, top of p. 132), these components are the chords $O\pi$, $O\rho$, *OS*, respectively. Now $O\pi+O\rho=OS$ yields the point *S* called for by the definition of the compound of the circles on the diameters *OP* and *OR*.